

SUPPORT FOR THE AMENDMENT

Claims 1, 4-6 and 12-19 are pending in this application. Claim 1 is independent.
Claims 6 and 12-16 are withdrawn from consideration pursuant to Restriction Requirement.

The present invention provides a pure titanium material more resistant to secular discoloration than conventional titanium materials. Specification at page 3, lines 8-10.

Claims 1, 4-5 and 17-19 are rejected under 35 U.S.C. § 103(a) over XP 00227868 ("XP-686") and ASM Handbook, vol. 2, page 1169 ("ASM") and further in view of JP 10-008234 ("JP-234").

In addition, Claims 1, 4-5 and 17-19 are rejected under 35 U.S.C. § 103(a) over JP 09-003573 ("JP-573") in view of JP-234.

XP-686 discloses high purity electrolytic titanium containing 0.009% Fe and iodide titanium containing 0.002% Fe. XP-686 discloses that an oxide film can form on titanium that leads to changes in surface color.

ASM discloses electrolytic titanium and iodide titanium having a Fe impurity limit of 0.009% and 0.002%, respectively.

JP-573 discloses pure titanium containing, by weight, Fe, Ni, and Cr in amounts satisfying $100 \leq \text{Fe} \leq 600$, $100 \leq \text{Ni} + \text{Cr} \leq 700$, and $\text{Fe} + \text{Ni} + \text{Cr} \leq 1000$ (unit: ppm), and also containing inevitable impurities. English-language machine translation of JP-573 at abstract.

JP-234 discloses preventing the generation of discoloration of outdoor titanium over a long period of time by regulating the surface roughness of the titanium to $\leq 3 \mu\text{m}$ by the center line average roughness Ra and by regulating the thickness of the oxidized coating on the surface to $\geq 20 \text{ \AA}$. English-language machine translation of JP-234 at abstract.

Any *prima facie* case of obviousness based on the cited prior art is rebutted by the significant improvement in resistance to secular discoloration that is achieved by the present

invention when, in accordance with independent Claim 1, "the titanium material is produced by a process that includes a finishing process comprising pickling the titanium; and heating the pickled titanium at a temperature X (°C) in a range of from 130°C to 280°C for a time T (minutes) so that $T \geq 239408 \times X^{-2.3237}$ ". The significant improvement in secular discoloration resistance that is achieved by the present invention is shown in the specification at Tables 3-4, reproduced below.

Table 3

| Heating process | Heating conditions | | | $239408 \times X^{-2.3237}$ |
|-----------------|--------------------------|--------------------|-------------|-----------------------------|
| | Heating temperature (°C) | Soaking time (min) | | |
| (A) | 130 | 3 | Atmospheric | 2.93 |
| (B) | 130 | 20 | Atmospheric | 2.93 |
| (C) | 130 | 60 | Atmospheric | 2.93 |
| (D) | 130 | 120 | Atmospheric | 2.93 |
| (E) | 200 | 1.1 | Atmospheric | 1.08 |
| (F) | 200 | 20 | Atmospheric | 1.08 |
| (G) | 200 | 60 | Atmospheric | 1.08 |
| (H) | 200 | 120 | Atmospheric | 1.08 |
| (I) | 280 | 0.5 | Atmospheric | 0.49 |
| (J) | 280 | 20 | Atmospheric | 0.49 |
| (K) | 280 | 60 | Atmospheric | 0.49 |
| (L) | 280 | 120 | Atmospheric | 0.49 |
| (M) | 130 | 120 | Vacuum | 2.93 |
| (N) | 200 | 120 | Vacuum | 1.08 |
| (O) | 280 | 120 | Vacuum | 0.49 |
| (P) | 130 | 2 | Atmospheric | 2.93 |
| (Q) | 200 | 0.5 | Atmospheric | 1.08 |
| (R) | 280 | 0.2 | Atmospheric | 0.49 |
| (S) | 280 | 150 | Atmospheric | 0.49 |

Table 4

| Specimen No. | Fe content (% by mass) | Nb content (% by mass) | Co content (% by mass) | Finishing process | Heat treatment process | ΔE^* |
|--------------|------------------------|------------------------|------------------------|-------------------|------------------------|--------------|
| 46 | 0.06 | 0.001 | 0.001 | Pickling | (A) | 0.4 |
| 47 | 0.06 | 0.001 | 0.001 | Pickling | (B) | 0.4 |
| 48 | 0.06 | 0.001 | 0.001 | Pickling | (C) | 0.3 |
| 49 | 0.06 | 0.001 | 0.001 | Pickling | (D) | 0.3 |
| 50 | 0.06 | 0.001 | 0.001 | Pickling | (E) | 0.4 |
| 51 | 0.06 | 0.001 | 0.001 | Pickling | (F) | 0.3 |
| 52 | 0.06 | 0.001 | 0.001 | Pickling | (G) | 0.3 |
| 53 | 0.06 | 0.001 | 0.001 | Pickling | (H) | 0.2 |
| 54 | 0.06 | 0.001 | 0.001 | Pickling | (I) | 0.3 |
| 55 | 0.06 | 0.001 | 0.001 | Pickling | (J) | 0.3 |
| 56 | 0.06 | 0.001 | 0.001 | Pickling | (K) | 0.2 |
| 57 | 0.06 | 0.001 | 0.001 | Pickling | (L) | 0.2 |
| 58 | 0.06 | 0.001 | 0.001 | Pickling | (M) | 0.4 |
| 59 | 0.06 | 0.001 | 0.001 | Pickling | (N) | 0.3 |
| 60 | 0.06 | 0.001 | 0.001 | Pickling | (O) | 0.3 |
| 61 | 0.03 | 0.001 | 0.001 | Pickling | (A) | 0.3 |
| 62 | 0.03 | 0.001 | 0.001 | Pickling | (B) | 0.2 |
| 63 | 0.03 | 0.001 | 0.001 | Pickling | (C) | 0.2 |
| 64 | 0.03 | 0.001 | 0.001 | Pickling | (D) | 0.2 |
| 65 | 0.03 | 0.001 | 0.001 | Pickling | (E) | 0.2 |
| 66 | 0.03 | 0.001 | 0.001 | Pickling | (F) | 0.2 |
| 67 | 0.03 | 0.001 | 0.001 | Pickling | (G) | 0.2 |
| 68 | 0.03 | 0.001 | 0.001 | Pickling | (H) | 0.1 |
| 69 | 0.03 | 0.001 | 0.001 | Pickling | (I) | 0.2 |
| 70 | 0.03 | 0.001 | 0.001 | Pickling | (J) | 0.1 |
| 71 | 0.03 | 0.001 | 0.001 | Pickling | (K) | 0.1 |

| | | | | | | |
|----|------|-------|-------|----------|-----|-----|
| 72 | 0.03 | 0.001 | 0.001 | Pickling | (L) | 0.1 |
| 73 | 0.03 | 0.001 | 0.001 | Pickling | (M) | 0.2 |
| 74 | 0.03 | 0.001 | 0.001 | Pickling | (N) | 0.2 |
| 75 | 0.03 | 0.001 | 0.001 | Pickling | (O) | 0.2 |
| 76 | 0.06 | 0.001 | 0.001 | Pickling | (P) | 0.7 |
| 77 | 0.06 | 0.001 | 0.001 | Pickling | (Q) | 0.7 |
| 78 | 0.06 | 0.001 | 0.001 | Pickling | (R) | 0.7 |
| 79 | 0.06 | 0.001 | 0.001 | Pickling | (S) | 0.1 |
| 80 | 0.03 | 0.001 | 0.001 | Pickling | (P) | 0.6 |
| 81 | 0.03 | 0.001 | 0.001 | Pickling | (Q) | 0.6 |
| 82 | 0.03 | 0.001 | 0.001 | Pickling | (R) | 0.6 |
| 83 | 0.03 | 0.001 | 0.001 | Pickling | (S) | 0 |

In Table 3, Heating Processes P, Q and R were carried out at soaking times that **did not satisfy** the independent Claim 1 relation $T \geq 239408 \times X^{-2.3237}$. Table 4 shows that Specimen Nos. 76, 77 and 78, which underwent one of Heating Processes P, Q and R, respectively, and were produced in conditions outside of the scope of Claim 1, each exhibits an inferior color difference ΔE^* of 0.7, and relative poor secular discoloration resistance.

In Table 3, Heating Processes A, B and C were carried out at soaking times that **did satisfy** the independent Claim 1 relation $T \geq 239408 \times X^{-2.3237}$. Table 4 shows that Specimen Nos. 46, 47 and 48, which underwent one of Heating Processes A, B and C, respectively; were produced in conditions within the scope of Claim 1; and have the same Fe, Nb and Co contents as Specimen Nos. 76, 77 and 78, each exhibits a color difference ΔE^* of 0.3 or 0.4, indicating significantly improved secular discoloration resistance.

A material having ΔE^* of 0.4 can clearly be distinguished from that having ΔE^* of 0.7. Thus, the reduction in ΔE^* from 0.7 to 0.4 indicates a significant improvement in resistance to secular discoloration.

The cited prior art fails to suggest the improved resistance to secular discoloration that is achieved by the product-by-process of the present invention. Thus, any *prima facie* case for the obviousness of the claimed invention is rebutted. As a result, the rejections under 35 U.S.C. § 103(a) should be withdrawn.

Pursuant to MPEP § 821.04, after independent product Claim 1 is allowed, Applicants respectfully request, rejoinder, examination and allowance of withdrawn method Claims 6 and 12-16, which include all of the limitations of product Claim 1.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

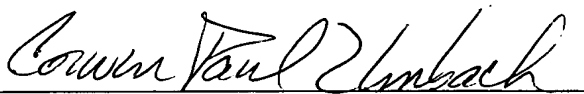
Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.
Norman F. Oblon

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 03/06)


Corwin P. Umbach, Ph.D.
Registration No. 40,211